Perspective

Sanitation Systems (/perspective/sanitation-systems-perspective)

Section

Sanitation Technologies (/sanitation-systems/sanitation-technologies)

Factsheet

Simplified Sewer

العربية (/ar/sanitation-systems/sanitation-technologies/simplified-sewer)

Applicable to

System 7 (/humanitarian-crises/rural-settings/sanitation/sanitation-systems/system-7%3A-blackwater-treatment-system-with-effluent-transport)

System 8 (/humanitarian-crises/urban-settings/sanitation/sanitation-systems/system-8%3A-blackwater-transport-to-%28semi-%29-centralized-treatment-system)

System 9 (/sanitation-systems/sanitation-systems/system-9%3A-sewerage-system-with-urine-diversion)

Application level

- City
- Household
- Neighborhood

Management level

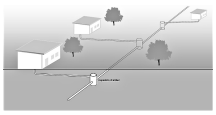
- Household
- Public
- Shared

Inputs

- Blackwater
- Brownwater
- Greywater
- Effluent

Outputs

- Blackwater
- Brownwater
- Greywater
- Effluent



Author/Compiled by
Eawag (Swiss Federal Institute of Aquatic Science and Technology)
Dorothee Spuhler (seecon international gmbh)
Beat Stauffer (seecon international gmbh)

Adapted from

Compendium of Sanitation Systems and Technologies. 2nd Revised Edition (/node/5587)

Executive Summary

A simplified sewer describes a sewerage network that is constructed using smaller diameter pipes laid at a shallower depth and at a flatter gradient than **conventional sewers (https://www.sswm.info/sswm-university-course/module-2-centralised-and-decentralised-systems-water-and-sanitation/further/conventional-sewers-(combined-sewers))**. The simplified sewer allows for a more flexible design at lower costs.

Advantages

- Can be laid at a shallower depth and flatter gradient than conventional sewers
- Lower capital costs than conventional sewers; low operating costs
- Can be extended as a community grows
- Greywater can be managed concurrently
- Does not require onsite primary treatment units

Disadvantages

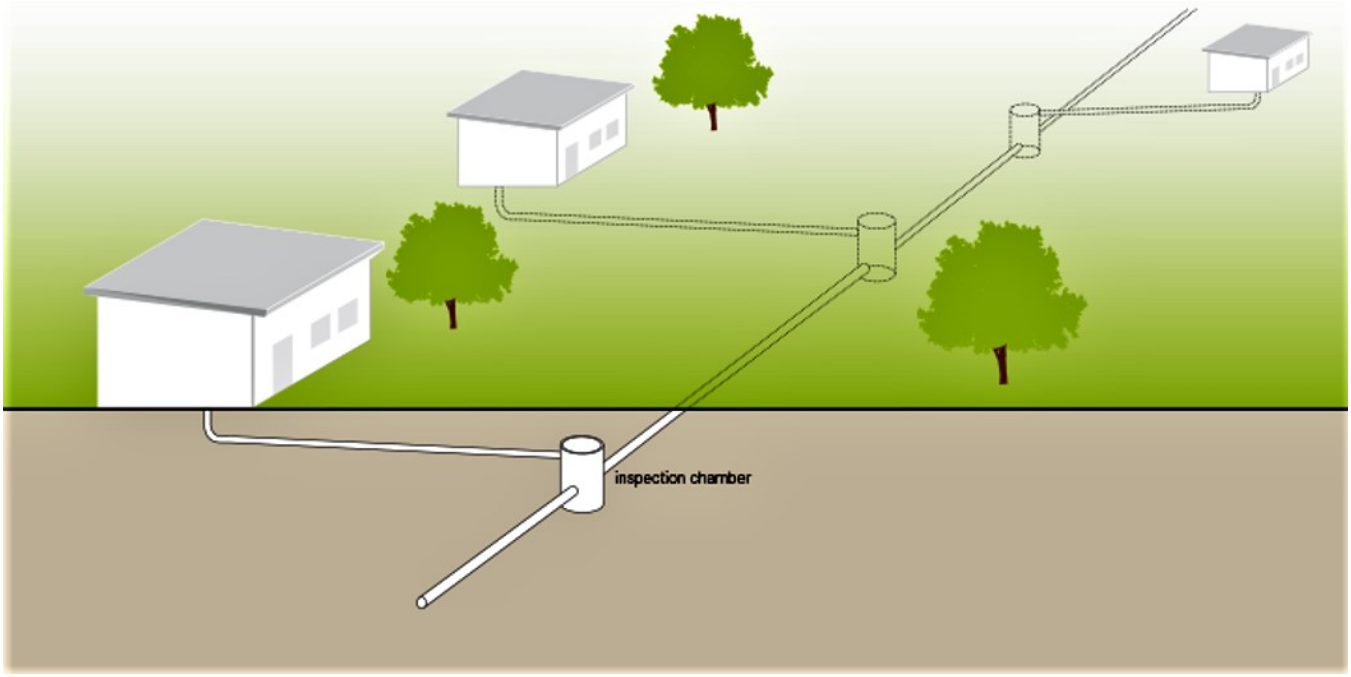
- Requires repairs and removals of blockages more frequently than a conventional gravity sewer
- Requires expert design and construction
- Leakages pose a risk of wastewater exfiltration and groundwater infiltration and are difficult to identify

In	Out
Blackwater, Greywater, Brownwater, Urine or Yellowwater, Non-biodegradable Wastewater	Blackwater, Non-biodegradable Wastewater

Introduction

Conceptually, simplified sewerage is the same as **conventional gravity sewerage (https://www.sswm.info/sswm-university-course/module-2-centralised-and-decentralised-systems-water-and-sanitation/further/conventional-sewers-(combined-sewers))**, but without unnecessarily conservative design

standards and with design features that are better adapted to the local situation. The pipes are usually laid within the property boundaries, through either the back or front yards, rather than beneath the central road, allowing for fewer and shorter pipes. Because simplified sewers are typically installed within the condominium, they are often referred to as condominial sewers. The pipes can also be routed in access ways, which are too narrow for heavy traffic, or underneath pavements (sidewalks). Since simplified sewers are installed where they are not subjected to heavy traffic loads, they can be laid at a shallow depth and little excavation is required.



Schematic of a simplified sewer system. Source: TILLEY et al. (2014)

Design considerations

In contrast to **conventional sewers (/sswm-university-course/module-2-centralised-and-decentralised-systems-water-and-sanitation/further/conventional-sewers-%28combined-sewers%29)** that are designed to ensure a minimum self-cleansing velocity, the design of simplified sewers is based on a minimum tractive tension of 1 N/m2 (1 Pa) at peak flow. The minimum peak flow should be 1.5 L/s and a minimum sewer diameter of 100 mm is required. A gradient of 0.5% is usually sufficient. For example, a 100 mm sewer laid at a gradient of 1 m in 200 m will serve around 2,800 users with a wastewater flow of 60 L/person/day. PVC pipes are recommended to use. The depth at which they should be laid depends mainly on the amount of traffic. Below sidewalks, covers of 40 to 65 cm are typical. The simplified design can also be applied to sewer mains; they can also be laid at a shallow depth, provided that they are placed away from traffic.

Expensive manholes are normally not needed. At each junction or change in direction, simple inspection chambers (or cleanouts) are sufficient. Inspection boxes are also used at each house connection. Where kitchen greywater contains an appreciable amount of oil and grease, the installation of grease traps (see **pre-treatment technologies (https://www.sswm.info/node/8289)**) is recommended to prevent clogging. Greywater should be discharged into the sewer to ensure adequate hydraulic loading, but stormwater connections should be discouraged. However, in practice it is difficult to exclude all stormwater flows, especially where there is no alternative for storm drainage. The design of the sewers (and treatment plant) should, therefore, take into account the extra flow that may result from stormwater inflow.

Health aspects/acceptance

If well constructed and maintained, sewers are a safe and hygienic means of transporting wastewater. Users must be well trained regarding the health risks associated with removing blockages and maintaining inspection chambers.

Operation & maintenance

Trained and responsible users are essential to ensure that the flow is undisturbed and to avoid clogging by trash and other solids. Occasional flushing of the pipes is recommended to insure against blockages. Blockages can usually be removed by opening the cleanouts and forcing a rigid wire through the pipe. Inspection chambers must be periodically emptied to prevent grit overflowing into the system. The operation of the system depends on clearly defined responsibilities between the sewerage authority and the community. Ideally, households will be responsible for the maintenance of pre-treatment units and the condominial part of the sewer. However, in practice this may not be feasible because users may not detect problems before they become severe and costly to repair. Alternatively, a private contractor or users committee can be hired to do the maintenance.

Applicability

Simplified sewers can be installed in almost all types of settlements and are especially appropriate for dense urban areas where space for onsite technologies is limited . They should be considered as an option where there is a sufficient population density (about 150 people per hectare) and a reliable water supply (at least 60 L/person/day).

Where the ground is rocky or the groundwater table high, excavation may be difficult. Under these circumstances, the cost of installing sewers is significantly higher than in favourable conditions. Regardless, simplified sewerage is between 20 and 50% less expensive than conventional sewerage.

Media PPT

Sewer Systems PPT (/media/90)

Library References

Simplified Sewerage: Design Guidelines

Design guidelines for manual calculations of simplified sewers.

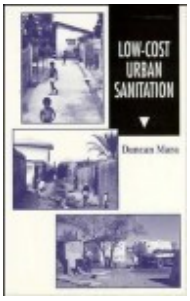
BAKALIAN, A. WRIGHT, A. OTIS, R. AZEVEDO NETTO, J. (1994): Simplified Sewerage: Design Guidelines. Washington, D.C.: United Nations Development Programme (UNDP), World Bank Water and Sanitation Program **URL (http://www.pseau.org/outils/ouvrages/wsp_world_bank_simplified_sewerage_design_guidelines_1994.pdf)** [Accessed: 22.07.2014]

Low-cost Sewerage

This article reviews low-cost sewerage options, their potential and their limitations. It also provides guidance on how to choose the most appropriate option, and gives examples of their successful application.

MARA, D. (1996): Low-cost Sewerage. Leeds: University of Leeds **URL (https://www.researchgate.net/publication/230888006_Low-Cost_Sewerage)** [Accessed: 28.05.2019]

Low-cost Urban Sanitation



This book covers the public health, technical, socioeconomic, sociocultural and institutional aspects of sanitation in towns and cities of developing countries. The text features excreta-related diseases and the use of sanitation to reduce their transmission. The sanitation technologies covered in detail are VIP latrines, pour-flush toilets, septic tanks, settled sewerage and simplified sewerage, with additional chapters on sullage disposal, pit emptying, and sewage treatment and reuse. Sociocultural constraints on sanitation systems and their socioeconomic costing are described, together with hygiene education, which is essential in order to achieve maximum benefits to health. The text also explains how to choose the most appropriate sanitation option for a given low-income community. Finally, institutional aspects are reviewed, including effective sanitation programme planning, monitoring and evaluation.

MARA, D. (1996): Low-cost Urban Sanitation. United Kingdom: Wiley

Sanitation for All in Periurban Areas? Only If We Use Simplified Sewerage

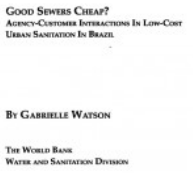
MARA, D. D. (2005): Sanitation for All in Periurban Areas? Only If We Use Simplified Sewerage. In: Water Science & Technology: Water Supply : Volume 5 , 57-65.

PC Based Simplified Sewer Design

The purpose of this document is to disseminate the simplified sewer technology more widely in the developing world, so that it can be used in peri-urban sanitation programmes and projects to improve health of poor communities. The document contains chapters on theory, planning and also practical advice.

MARA, D. SLEIGH, A. (2001): PC Based Simplified Sewer Design. Leeds: University of Leeds **URL (https://www.ircwash.org/sites/default/files/332-01PC-16418.pdf)** [Accessed: 28.05.2019]

Good Sewers Cheap? Agency-Customer Interactions in Low-Cost Urban Sanitation in Brazil


Good Sewers Cheap?
Agency-Customer Interactions In Low-Cost Urban Sanitation In Brazil
By Gabrielle Watson
The World Bank
Water and Sanitation Division

This document surveys how the condominial system enables poor communities to investigate sewerage options and later provoke timely responses from neighbours and agencies when repairs or modifications become necessary.

WATSON, G. (1995): Good Sewers Cheap? Agency-Customer Interactions in Low-Cost Urban Sanitation in Brazil. Washington, D.C.: The World Bank, Water and Sanitation Division, US **URL (http://www.wsp.org/sites/wsp.org/files/publications /global_goodsewerscheap.pdf)** [Accessed: 22.07.2014]